PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Confirmation No.: 3370
Yasuhiro MATSUMOTO et al.	Art Unit: 2831
Serial No.: 10/720,986	Examiner: Eric W. THOMAS
Filed: November 25, 2003	Docket No.: 101175-00039
For: ELECTRICAL DOUBLE-LAYER CAPACITOR	

DECLARATION UNDER 37 C.F.R. § 1.132

Commissioner for Patents
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Sir:

I, Mr. Kenji Sato, hereby state and declare as follows:

1. I am a citizen of Japan, residing at Wako-shi, Saitama.

2. In March 1980, I graduated from the Course of Chemistry at Tohoku University, and since September 1986, have been employed by Honda R&D Co., Ltd. Since April 1990, I have been engaged, at that Employer, mainly in the field of development of electric energy storage devices. Since January 1994, up to the present, I have been involved in capacitor study concerning electrolytes.

3. I am very familiar with the present invention, the above-identified application, the Office Action dated July 15, 2004, and the references cited therein.

4. I have compared the electrical double-layer capacitor having an electrode element that is impregnated with a nonaqueous electrolyte solution containing the impurity range as set forth in the subject application of the claimed invention and provide an explanation below.

As defined in or by the amended claim 1, a feature of the claimed invention is the range of impurities in the nonaqueous electrolyte solution impregnated into the electrode element. In the present invention as recited in claim 1, the impurities contained in the nonaqueous electrolyte solution impregnated into the electrode element comprise 30 ppm or less of glycols, 30 ppm or less of primary alcohols, and less than 20 ppm of tertiary amines.

I have conducted experiments and determined that the claimed range produces surprising and unexpected results. Particularly, an electrical double-layer capacitor having an electrode element that is impregnated with a nonaqueous electrolyte solution containing the claimed impurity range exhibits only a slight increase in resistance even when used under continuous application of a voltage for a long period of time.

More specifically, Tables 1 and 2 of the specification as filed, which are included here as Appendix A, show resistances in electrical double-layer capacitors before and after a voltage has been applied to the electrical double-layer capacitors for a duration of 256 hours. Table 1 shows the initial and final (after 256 hours of continuous voltage application) resistances of electrical double-layer capacitors having propylene glycol concentrations of 3 ppm, 23 ppm, 58 ppm, and 112 ppm. Table 2 shows the initial and final (after 256 hours of continuous voltage application) resistances of electrical double-layer capacitors having n-butanol (primary alcohol) concentrations of 2 ppm, 22 ppm, 53 ppm and 102 ppm. Figs. A and B of Appendix B are graphs illustrating the plotted data of Tables 1 and 2, respectively.

As illustrated in Figs. A and B, the resistance-increasing rate after 256 hours abruptly dramatically improves in the vicinity of the claimed range of glycols and primary alcohols (impurities). Therefore, it cannot be said that it is apparent that a capacitor with dramatically improved performance can be obtained by reducing the content of impurities. Moreover, it cannot be said that it is apparent that a capacitor with dramatically improved performance can be obtained by reducing the content of impurities to the claimed range.

I have conducted an additional experiment to further demonstrate the superiority of the present invention. The results of this additional experiment are illustrated in appended Fig. C and Table A of Appendix C. Fig. C and Table A show the results of an experiment measuring the resistance-increasing rate after 500 hours voltage application duration using capacitor cells each having a different content of n-butanol, a representative of primary alcohols, in order to fortify the results shown in Fig. B. As is apparent from Fig. C, the resistance-increasing rate gradually improves when decreasing the content of primary alcohols from 1000 ppm, as disclosed in Watanabe. However, the improvement becomes apparent only when the content of primary alcohols is approximately 53 ppm or less.

Watanabe discloses regulating the primary alcohols content to the broad range of 1000 ppm or less. *See col. 5, lines 1-41 of Watanabe.* It is not technically difficult to limit the content of primary alcohols to 1000 ppm or less, and no advanced technology is required to do so. However, in order to limit the content of primary alcohols to 30 ppm or less as in the claimed invention, advanced technology is required to purify the electrolyte solution, remove impurities contained in components of the electrical double-layer capacitor cell, and perform the production process therefor.

As is apparent from Figs. A, B and C, and Tables 1, 2 and 3, there is a considerable difference in the resistance-increasing ratio between an electrical double-layer capacitor having an electrode element that is impregnated with a nonaqueous electrolyte solution containing primary alcohols of 30 ppm or less, as in the claimed invention, and the

content of primary alcohols disclosed in the cited references. Even when decreasing the content of the primary alcohols from 1000 ppm as disclosed in Watanabe, the improvement in resistance-increasing ratio becomes apparent only when the content of primary alcohols is approximately 53 ppm or less.

In the claimed invention, primary alcohols are significantly limited to a range of 30 ppm or less. As explained above, the experiments conducted for comparing the claimed invention with that which is disclosed by the applied art of record confirm that the claimed invention is superior in resistance-increasing ratio, and thus durability, over the cited references. The increase in resistance, which would occur by using the teachings of the cited references, leads to a drop in voltage during large electric current, and further leads to reducing energy available during high output. These negative effects of increased resistance that occur in the cited references are significantly reduced in the claimed invention by the effectiveness of the invention as claimed to suppress such increased resistance.

As previously described, by limiting the amount of impurities in the nonaqueous electrolyte solution used to impregnate the electrode element of the claimed invention, the claimed invention is highly effective in suppressing an increase in resistance.

The electrical double-layer capacitor having an electrode element that is impregnated with a nonaqueous electrolyte solution containing the claimed range of impurities exhibits unexpected improvement in the capacitor, even to the person skilled in the art, as compared to that satisfying the broad range of impurities of 1000 ppm or less disclosed by Watanabe.

5. Consequently, the applied art of record, i.e., Ue et al. (JP 2000-331887), Ue et al. (JP 2000-311839) and Watanabe et al. (US 6,459,564), alone or in combination, can not and does not teach or suggest the electrical double-layer capacitor having an electrode element that is impregnated with a nonaqueous electrolyte solution containing impurities

of 30 ppm or less of glycols, 30 ppm or less of primary alcohols, and less than 20 ppm of tertiary amines, as set forth in the claimed invention.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Kenji Sato

Kenji Sato
Signed this First day of December 2004.

APPENDIX A

[Table 1]

	Propylene glycol concentration (ppm)	Resistance-increasing ratio (%)
Example 1	3	103.5
Example 2	23	104.3
Comparative Example 1	58	108.7
Comparative Example 2	112	113.1

[Table 2]

	n-Butanol concentration (ppm)	Resistance-increasing ratio (%)
Example 1	2	103.5
Example 3	22	102.5
Comparative Example 3	53	105.1
Comparative Example 4	102	109.9

APPENDIX B

FIG. A

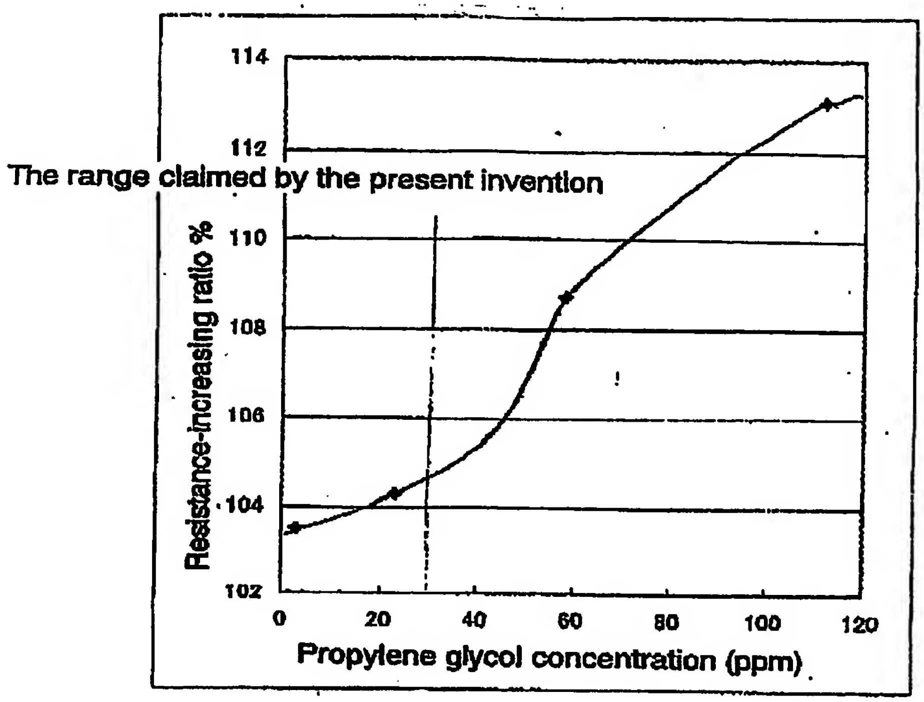
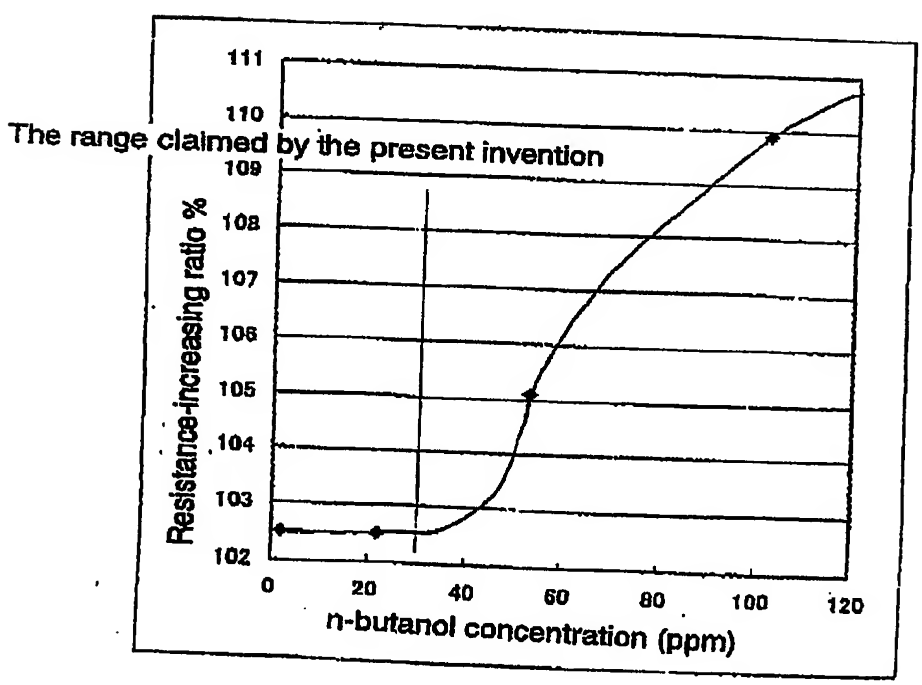


FIG. B



APPENDIX C

Table A Relationship between resistance-increasing ratio after 500 hours duration test and content of primary alcohols

Primary alcohols content ppm	Resistance-increasing ratio %
0	111.9
22	114.2
53	124.1
102	128.4
500	131.0

FIG. C Relationship between resistance-increasing ratio after 500 hours and content of n-butanol